Correlative Multiple-length-scale X-ray Microscopy at SSRL

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The studies of complex heterogeneous systems, e.g. research in functional materials and geoscience, usually requires a suite of analytical tools that are capable of providing complementary information about material properties at different length scales. This is due to the fact that the heterogeneity of the complex system usually exists across a wide range of length scales.

X-ray microscopy offers several different imaging modalities, such as full-field X-ray microscopy, scanning X-ray microscopy, and coherent-based X-ray microscopy. These imaging modalities probe structural and chemical information at different scales ranging from macro-, micro-, meso-, to nano- scales, depending on the X-ray optics used and the configuration of the imaging systems. The pros and cons (in resolving power, sensitivity, data acquisition speed, etc.) of each individual X-ray imaging method naturally make the case that the correlative imaging is powerful and beneficial for scientific studies in many fields.

In this presentation, we show our efforts to establish multiple-length-scale X-ray microscopy platform at SSRL [1-4]. We demonstrate the strength of correlative multiple-length-scale X-ray microscopy by presenting two systematic research works, one on complex heterogeneous catalysis material for petroleum refining [5] and the other one on underground formation for CO_2 sequestration [6]. The scientific cases serve as good examples to show the link between the macroscopic behavior and the microscopic properties at multiple-length-scales.

References

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